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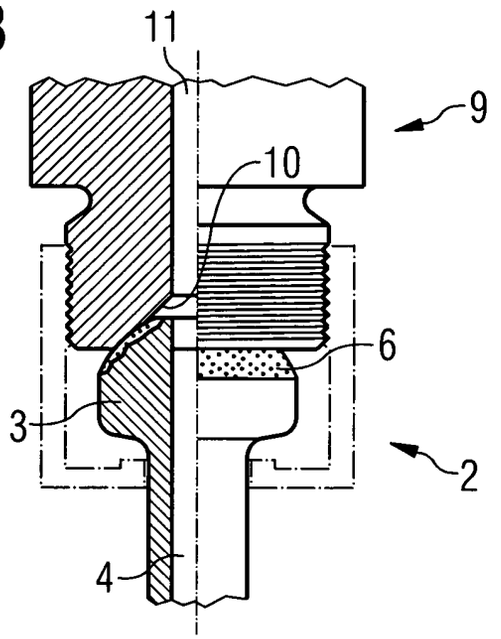
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(54) Connecting arrangement

(57) A connecting arrangement with a first and second component (2,9), the second component (9) has a tapered recess (10) at whose narrow end a tubular recess (11) of the second component (9) connects. The first component (2) has a mushroom-head-shaped connecting element (3) with a further tubular recess (4). The mushroom-head-shaped connecting element (3) can be pressed against the other component in the area of the tapered recess. At least in the area in which the mushroom-head-shaped connecting element (3) is in contact with the second component (9) when it is pressed against the second component (9), the connecting element (3) is provided with a sealing material (6) the hardness of which is less than that of the material of the second component (9) of which the second component (9) consists at least in the area of contact with the connecting element.

FIG 3



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Description

[0001] The invention relates to a component that is suitable for connecting to a further component, and a connecting arrangement with a first and second component. A component of this kind or a connecting arrangement of this kind is particularly suitable for use in a fuel supply device of an internal combustion engine.

[0002] From WO 01/71179 A2, an injection valve for an internal combustion engine is known and the arrangement of the injection valve in a fuel feed device of an internal combustion engine. The injection valve has a connecting element that is fitted into a tubular recess of a connection of a fuel rail. The connecting element of the injection valve also has a tubular recess. The injection valve has a sealing ring that is arranged radially around the connecting element. Furthermore, a thread, a mating thread, a ring and a taper are provided that interact with each other in such a way that when the thread is screwed onto the mating thread the ring tensions the taper radially in the direction of the connecting element of the injection valve and thus fixes the connecting valve. To use this arrangement for fuel feed devices with very high pressures, such as for example occur in internal combustion engines with direct fuel injection, where pressures of 180 bar occur for gasoline and up to 2000 bar for diesel, the individual elements must be very precisely manufactured to guarantee a good seal. An arrangement of this kind is therefore extremely expensive for use at high fuel pressures.

[0003] The object of the invention is to create a component that on the one hand is simple and on the other hand guarantees a reliable seal at high pressure in the component when connected to another component. It is furthermore the task of the invention to create a connecting arrangement with a first and second component, that on the one hand is simple and on the other hand guarantees a reliable seal between the first and second component with high pressure in the components.

[0004] This object is achieved with regard to the component by the features of Claim 1. The object is achieved with regard to the connecting arrangement by the features of Claim 6. Advantageous embodiments of the invention are given in the subclaims.

[0005] The invention is distinguished by a component that is suitable for connecting to another component, with the other component having a tapered recess at whose narrow end a tubular recess of the other component connects. The component has a mushroom-head-shaped connecting element with a further tubular recess. The mushroom-head-shaped connecting element can be pressed against the other component in the area of the tapered recess. At least in the area in which the mushroom-head-shaped connecting element contacts the other component when it is pressed against the other component, the connecting element is provided with a sealing material the hardness of which is less than that of the material of the other component of which the other component consists at least in the area of contact with the connecting element. In this way, a very good seal, a simple assembly of the first component to the other component with at the same time less stress on the component due to push forces is guaranteed.

[0006] In an advantageous embodiment of the invention, the sealing material is pressed onto the mushroom-head-shaped connecting element. In this way, the sealing material can be simply matched to the mushroom-head shape of the connecting element and durably connected to the connecting element in a simple manner. This advantageous embodiment of the invention in particular enables a ring to be used as the sealing material, said ring being matched to the mushroom-head shape of the connecting element by the press tool and being connected to it. Such rings are cheap and freely available.

[0007] In a further advantageous embodiment of the invention, the sealing material consists of aluminum or copper. The advantage of this is that the aluminum or copper materials have properties that make them particularly suitable for sealing.

[0008] In a further advantageous embodiment of the invention, the component has a thread that is suitable for screwing into a mating thread that is formed in the other component. In this way the component can be very simply assembled to the other component, with only a slight torque having to be applied when screwing up the thread, and a reliable assembly is thus enabled. Further advantageous embodiments of the invention are given in the subclaims.

[0009] Exemplary embodiments of the invention are explained in the following with the aid of schematic drawings. These are as follows:

Figure 1 An internal combustion engine with a fuel feed device.

Figure 2 A first and second component.

Figure 3 A connecting arrangement with the first and second component.

[0010] Elements of the same design and function that occur in different illustrations are identified by the same reference character.

[0011] A fuel feed device is assigned to an internal combustion engine (Figure 1). The fuel feed device is designed for use in internal combustion engines with direct metering of the fuel to the cylinders of the internal combustion engine at high pressure, for example 200 bar. It includes a fuel tank 20, that is connected via a first fuel line to a low-pressure pump 21. At the output end, the low-pressure pump 21 is connected to an inlet 23, of a high-pressure pump 24. Furthermore, at the outlet of the low-pressure pump 21, a mechanical regulator 22 is provided, the output of which is actively connected via a further fuel line to the fuel tank 20. The inlet 23 is

connected to the high-pressure pump 24 that at its output end pumps fuel to the fuel accumulator 25. The high-pressure pump 24 is usually driven by the crankshaft or camshaft of the internal combustion engine and thus at a constant speed of the crankshaft delivers a constant fuel volume to the fuel accumulator 25.

[0012] Injection valves 29 are actively connected to the fuel accumulator 25. The fuel is thus fed to the injection valves 29 via the fuel accumulator 25. The injection valves 29 have a sealed connection to the fuel accumulator 25.

[0013] Figure 2 shows a first component 2 and a second component 9. The first component 2 can, for example, be an injection valve 29. The second component 9 can for example, be part of the fuel accumulator 25.

[0014] The first component 2 has a mushroom-head-shaped connecting element 3 with a tubular recess 4 that is suitable for the passage of fluid, particularly fuel. The mushroom-head-shaped connecting element 3 is provided with a sealing material 6. Furthermore, the first component 2 has a thread 7 that is suitable for screwing onto a mating thread 12 of the second component 9.

[0015] The second component 9 also has a tapered recess 10, at whose narrowed end a tubular recess 11 of the second component 9 connects. The tubular recess 11 is advantageously designed so that it forms a connection to a fuel volume in the fuel accumulator 25.

[0016] Figure 2 shows a connection arrangement of the first component 2 and second component 9. The thread 7 is engaged with the mating thread 12, by which means the mushroom-head-shaped connecting element 3 is pressed against part of the tapered recess 10. The sealing material 6 is located at least in this contact area.

[0017] The mushroom-head-shaped connecting element 3 is, for example, hemispherical or in the form of a half ellipse. In this way a particularly high surface pressure in the area of the contact of the mushroom-head-shaped connecting element 3 with the second component 9 in the area of the tapered recess 10 is guaranteed, with at the same time only light torque being necessary to screw the thread 7 onto the mating thread. This means that the first component 2 is not overstressed.

[0018] The sealing material 6 is matched to the mushroom-head shape of the connecting element and has a hardness that is less than the hardness of the second component 9, i.e. of the material of the second component 9 that is present in the area of the tapered recess 10. The material of the second component 9 is preferably steel. The sealing material is preferably copper or aluminum, whose hardness is less than the hardness of the steel of the second component 9. The hardness of a material is normally determined using a Brinell or Mohs hardness test.

[0019] The sealing material 6 is plastically deformed by the high surface pressure in the area of contact with the tapered recess 10 of the second component 9 and thus in conjunction with the mushroom-head shape of the connecting element ensures an extremely reliable seal at high pressure in the component, i.e. at a high pressure of the fluid flowing through the tubular recess 11 of the second component and then on through the tubular recess 4 of the first component.

[0020] It has been shown to be particularly advantageous if the sealing material is applied to the mushroom-head-shaped connecting element 3 by pressing. The advantage of this is that a simple, cheaply available standard component, such as a ring, can be used as the sealing material and this can then be adapted to the shape of the mushroom-head-shaped connecting element, and also be permanently connected to it, by means of the press tool and of the mushroom-head-shaped connecting element.

[0021] As an alternative, however, the sealing material 6 can also be applied in a different manner, for example by welding, which however has been shown to be more expensive. The sealing material 6 can also consist of a metal other than aluminum or copper provided this metal or material has the properties necessary to form the seal.

[0022] The thread 7 and mating thread 12 represent a particularly simple means of applying the necessary surface pressure in the area of the seal. Alternatively, the first component 2 can, however, also be pressed against the second component with the aid of external forces and then fixed in this position, for example by crimping.

Claims

1. Component that is suitable for connecting to another component, with

   - the second component (9) having a tapered recess (10) at whose narrow end a tubular recess (11) of the other component (9) connects,
   - the component (2) having a mushroom-head-shaped connecting element (3) with another tubular recess (4),
   - the mushroom-head-shaped connecting element (3) being able to be pressed against the other component (9) in the area of the tapered recess (10) and
   - at least in the area in which the mushroom-head-shaped connecting element (3) contacts the other component (9), if it is pressed against the other component (9), the connecting element (3) being provided with a sealing material (6) the hardness of which is less than that of the material of the other component (9) of which the other component (9) consists at least in the area of contact with the connecting element (3).

2. Component in accordance with Claim 1, **character-**

ized in that
the sealing material (6) is pressed against the mushroom-head-shaped connecting element (3).

3. Component in accordance with one of the preceding claims, **characterized in that** the sealing material is aluminum or copper.

4. Component in accordance with one of the preceding claims, **characterized in that** it has a thread (7) that is suitable for screwing onto a mating thread (12) formed in the other component (9).

5. Component in accordance with one of the preceding claims, **characterized in that** the component (2) is an injection valve in an internal combustion engine.

6. Connecting arrangement with a first and second component, with the first component being the component (2) in accordance with one of Claims 1 to 5,

- the second component being the other component (9) in accordance with one of Claims 1 to 5 and
- the mushroom-head-shaped connecting element (3) is pressed against the second component (9) in the area of the tapered recess (10).

FIG 1

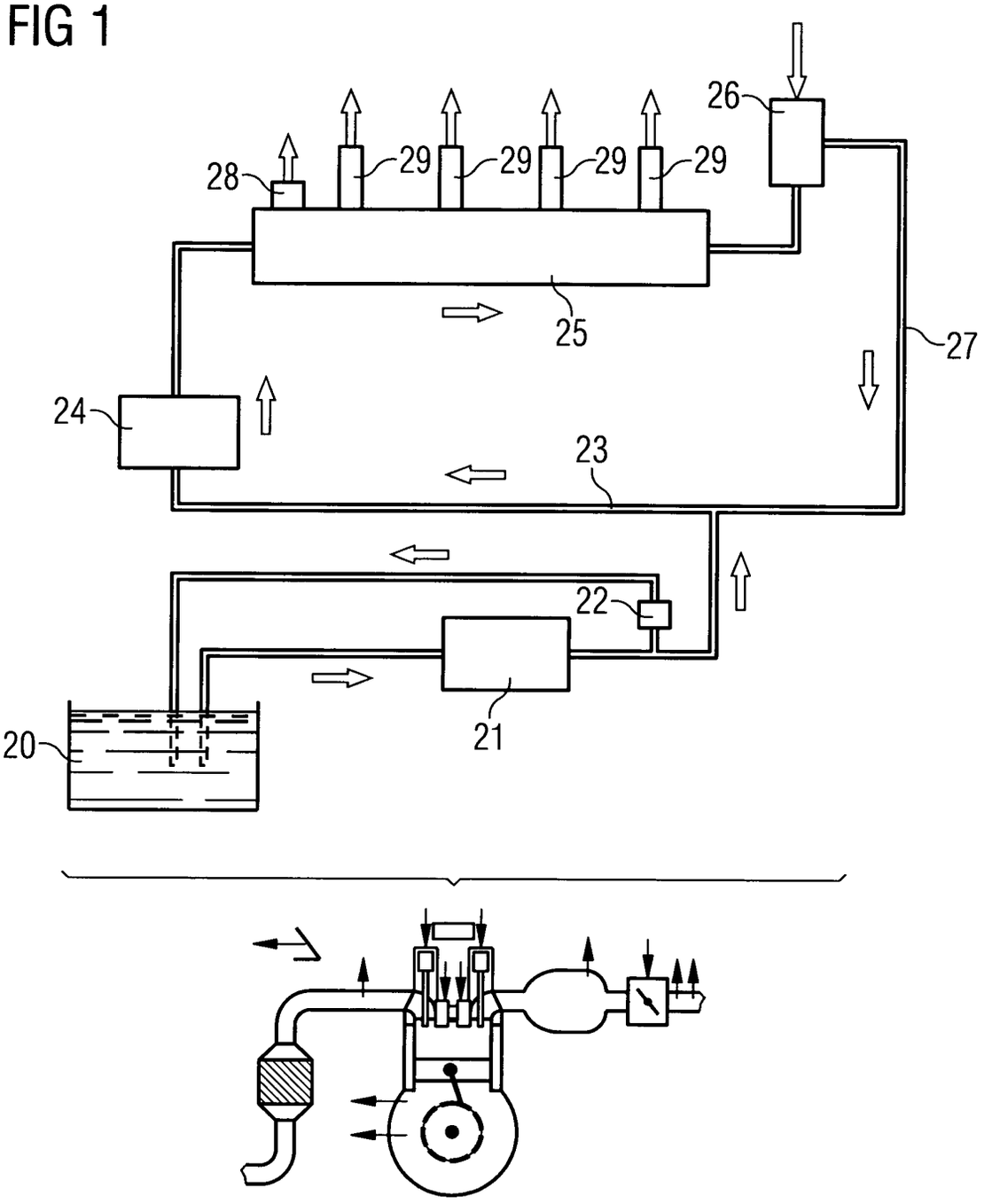


FIG 2

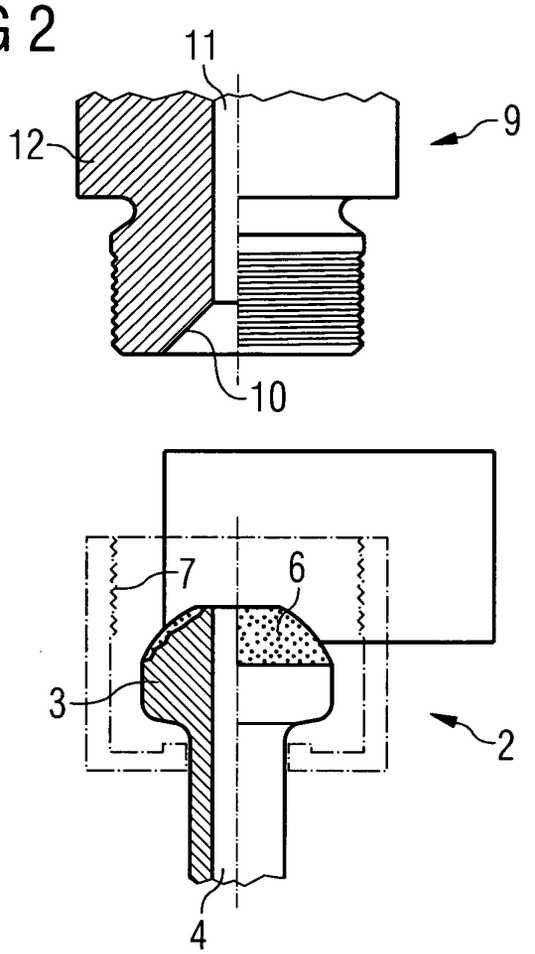
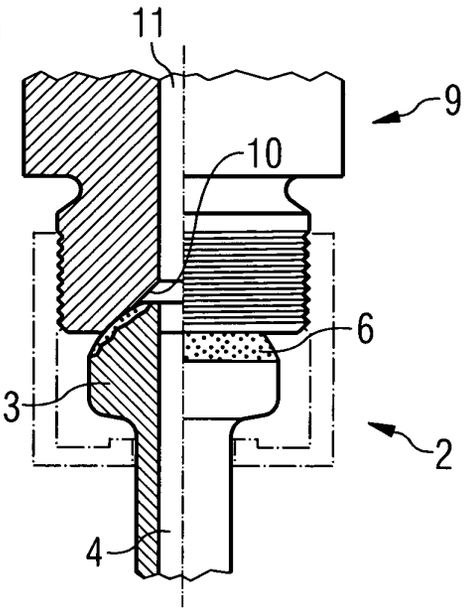


FIG 3



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EUROPEAN SEARCH REPORT

Application Number
EP 03 01 4324

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F02M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	20 October 2003	Torle, E

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 03 01 4324

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